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GROWING AND GRAFTING OLIVE SEEDLINGS

PART I. GROWING OLIVE SEEDLINGS

BY

F. T. BIOLETTI AND W. F. OGLESBY

PART II. GRAFTING OLIVE SEEDLINGS

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F. T. BIOLETTI AND F. C. H. FLOSSFEDER

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various percentages of imperfect seeds. By breaking their shells and examining the kernels, the proportion of good to poor was determined for a number of samples with the results shown in Table I.

TABLE I

RATIOS OF GOOD TO POOR SEED

No. of test		No. of seeds	Good seed, per cent	Poor seed, per cent
1.	Pendulina; Niles, Alameda Co.	50	100.0	.0
2.	Redding; Davis, Yolo Co.	100	99.0	1.0
3.	Medium sized olives; Tehama Co.	24	96.0	4.0
4.	Small sized olives; Tehama Co.	61	91.8	8.2
5.	Mission; Davis (1913), Yolo Co.	38	89.5	10.5
6.	Picholine d'Aix; Niles, Alameda Co.	36	86.1	13.9
7.	Mission; Davis (1914), Yolo Co.	100	86.0	14.0
8.	Redding; Fresno	709	85.2	14.8
9.	Rubra; Niles, Alameda Co.	40	85.0	15.0
10.	Atro Rubens; Niles, Alameda Co.	50	80.0	20.0
11.	Columella; Niles, Alameda Co.	100	79.0	21.0
12.	Polymorpha; Niles, Alameda Co.	50	78.0	22.0
13.	Oblonga; Corning, Tehama Co.	27	74.0	26.0
14.	Regalis; Niles, Alameda Co.	50	66.0	34.0
15.	Seedling; University Campus	550	60.5	39.5
16.	Razzo; University Campus	250	54.0	46.0

Percentage of good seed: Maximum, 100%. Minimum, 54%. Average, 81.9%.

This table indicates that the percentage of viable seeds differs with the variety, with the locality and with the season. Pendulina from Niles showed 100 per cent of good seed, while Regalis from the same locality showed only 66 per cent. Redding from Davis showed 99 per cent, while the same variety from Fresno showed 85.2 per cent; Mission from Davis in 1913 showed 89.5 per cent and in 1914, 86 per cent. The common belief that the seeds of the Mission contain imperfect kernels is evidently not true in all cases.

In order to obtain a true comparison in the germinating tests a method was sought of separating the good seed from the poor. Such a method would be of value also to the propagator, as it would enable him to avoid the useless handling of worthless seed. As the good seed is of higher specific gravity, it was possible to separate it from the poor by means of a solution of common salt. The good, heavy seed sank, and the light, worthless seed floated.

It is necessary that the salt solution be of the proper strength. If too strong many good seeds will float and be lost and if too dilute many poor seeds will sink and fail to be eliminated. The proper

concentration of the salt solution depends on the condition of the pits. If the pits are used as soon as they are cleaned from the pulp, an almost perfect separation is obtained by the use of a 25 per cent solution, that is, a brine made by dissolving 25 parts of salt in 100 parts of water by weight. If the pits are dried for several weeks. a 10 per cent solution gives the best results. If the dried seeds are soaked in water for two days they can be separated satisfactorily in a 25 per cent solution. If soaked for a long time—fifteen days —the poor seed becomes as heavy as the good and cannot be separated. The seeds of a few varieties, such as the Mission, with exceptionally thick, heavy shells require a still more concentrated solution. Redding seed and all varieties with small seeds which were tested were separated well in a 25 per cent solution. Table II shows the results obtained in separating the fresh seed of various varieties in a 25 per cent brine.

TABLE II

SEPARATION OF GOOD SEED FROM POOR IN 25 PER CENT BRINE

No. of test	No. of seeds used	Per cent of good seeds	No. that sank		No. that floated		Per cent of good seed retained	Per cent good in seed retained
			Good	Poor	Good	Poor		
1. Pendulina; Niles	50	100	47	....	3	....	94	100
2. Redding; Davis	50	98	49	*1	....	....	100	98
3. Medium sized olive; Corning	24	96	23	*1	....	....	100	96
4. Small olive; Corning	61	92	56	*1	....	4	100	92
5. Pich. d'Aix; Niles	36	86	31	....	....	5	100	100
6. Rubra; Niles	40	85	33	*1	1	5	94	94
7. Atro Rubens; Niles	50	80	40	*3	....	7	100	93
8. Columella; Niles	100	79	78	*2	1	19	99	98
9. Polymorpha; Niles	50	78	39	*1	....	10	100	98
10. Oblonga; Corning	27	74	20	*2	....	5	100	91
11. Regalis; Niles	50	66	33	*2	....	15	100	94
12. Seedling; U. C. Campus	100	58	58	*8	....	34	100	88
13. Razzo; U. C. Campus	50	54	27	*2	....	21	100	93

*Very small seed.

Good kernels in seed before separation 78.3%
Good kernels in seed after separation 95.7%
Good kernels lost in separation .... .93%
Poor seed eliminated 81.2%

From this table it will be seen that before separation, an average of 21.7 per cent of all the seed was worthless. After separation, of the seed recovered, only 4.3 per cent was poor. Less than 1 per cent of

the good seed was lost and over 80 per cent of the poor seed was eliminated.

The high specific gravity of the few bad seeds which sank was due to the fact that they were solid to the center with no apparent kernel cavity. They were all much smaller than the normal seeds and would be removed by screening. Separation by immersion in brine, followed by removal of small seeds by screening, would therefore be practically perfect.

Most of the germination tests were made with Redding[1] seed, as this variety seems particularly suitable for a stock. The percentage of viable seeds was high in all cases and in some cases there was practically no bad seed. Where seed of this variety is used the main use of the brine test would be to determine the quality of the seed as a whole, in order to decide whether the sample was suitable for planting, as our observations indicate that where a large percentage are not viable even those which germinate produce weak plants.

B. PRELIMINARY TREATMENT OF THE SEED

If olive seeds are planted either with or without the pulp and without treatment, most of them do not germinate for a year or more. This appears to be due to the oil present and to the thick woody pit, which delay the penetration of water, without which the seeds cannot germinate.

The usual method of handling the seeds is to "stratify" them for about sixteen months and then to plant either in "flats" or directly in the nursery. Two methods of stratification are used. In one, the olives are mixed with sand and placed in a box or pit. They are kept moist continuously from about December until March of the second spring following, when they are planted in the flats. Another method is to plant the seeds about an inch apart in a box or bed and keep them moist until they germinate and grow several inches. This will take nearly two years. They are then transplanted to flats or directly into the nursery. There is a loss of a whole year in each case.

Various methods have been recommended for hastening the germination of olive seeds. All of them are attempts to increase the permeability of the seed to water by removing the oil or by softening or breaking the stone. Among these are soaking in warm water or in alkaline or acid solutions, feeding the olives to turkeys and using them after they have passed through the digestive tract, and cracking the stones in a vise.

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[1] Usually known by the misleading name of "Redding Picholine."

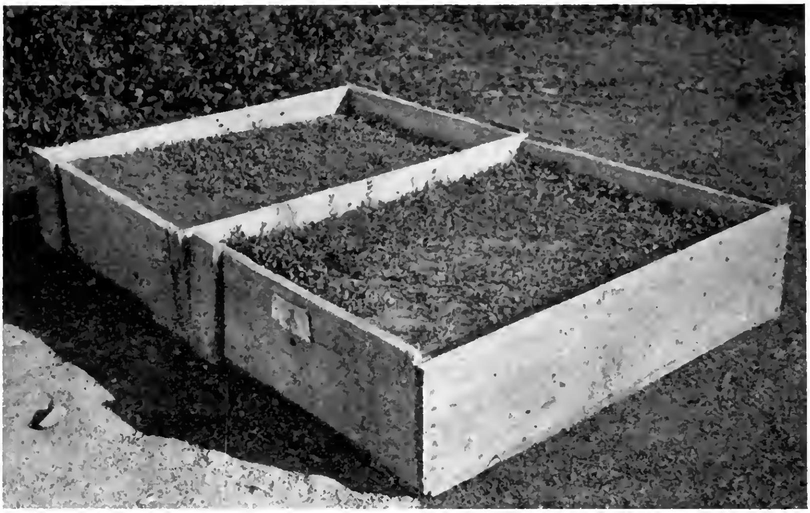


Fig. 1.—Redding olive seeds sprouting in a large box. These seeds were stratified by the first method in December, 1912, and left until April, 1914, when they were planted in the box shown. The photograph was taken twenty months after the seed was gathered.

Fig. 2.—Redding olive seeds sprouting in 4-in. flats. These seeds were clipped in March, 1913, and planted in the flats as shown. The photograph was taken in August, 1913, five months after the seeds were gathered, showing a gain of more than fifteen months over the stratifying method.

In order to test the most promising of these methods, several series of experiments were made. In the first, pits of a small-fruited seedling growing in the University grounds were used. By examination it was found that only 60.5 per cent of the pits had apparently perfect kernels (see No. 15, Table I). The light seed was removed by means of a 25 per cent salt solution, the proportion of good seed being thus increased to 88 per cent (see No. 12, Table II). The experiments included soaking in water and in various solutions. Breaking or cracking the shell of the pit by means of a vise was found too slow and by use of a hammer too many were broken. It was found possible, however, to cut off a piece of the shell by means of a specially designed pincer rapidly and without injury to the seed. Experiments based on this method were also included.

The seeds, after being separated in the salt solution, were divided into thirteen lots and treated as indicated in Table III.

The various lots were all planted on March 18, 1913, directly after treatment. They were placed in the greenhouse in shallow boxes containing a mixture of three parts sand and one part garden loam. They were put in about half an inch deep, the soil firmed and kept moist at all times. The germination results are given in Table III.

TABLE III

EFFECT OF PRELIMINARY TREATMENT OF SEED ON GERMINATION

No. of test	Treatment	No. used	Number sprouting June 1	Number sprouting July 1	Number sprouting Aug. 16	Per cent sprouting of Good seed	Per cent sprouting of Seed planted	Per cent sprouting of Original seed
1.	Soaked and apex clipped	250	32	98	121	55	48	29
2.	Soaked and base clipped	250	6	59	110	50	44	27
3.	Dry seed, apex clipped....	125	24	46	55	50	44	27
4.	Dry seed, notch filed	50	1	6	18	41	36	22
5.	Dry seed, base clipped	150	12	39	40*	30	27	16*
6.	1 hr. 10% H_2SO_4	200	2	23	48	27	24	15
7.	16 hrs. 10% KOH	100	0	2	21	24	21	13
8.	Untreated—dry	250	4	11	45	20	18	11
9.	Soaked 15 days	2075	1	62	360	19	17	10
10.	30 min. strong H_2SO_4	200	2	13	27	15	14	8
11.	42 hrs. in lime paste........	50	0	0	5	11	10	6
12.	8 hrs. 10% KOH†	100	1	4	†	....	....	....
13.	Pulp not removed	100	0	0	....	....	....	....

* Some of the seedlings of No. 5 were lost by damping off.

† Experiment lost.

These results indicate that not only was there a large proportion of obviously imperfect seed in the original fruit, but that even the separated and apparently perfect seed had low germinating power. After

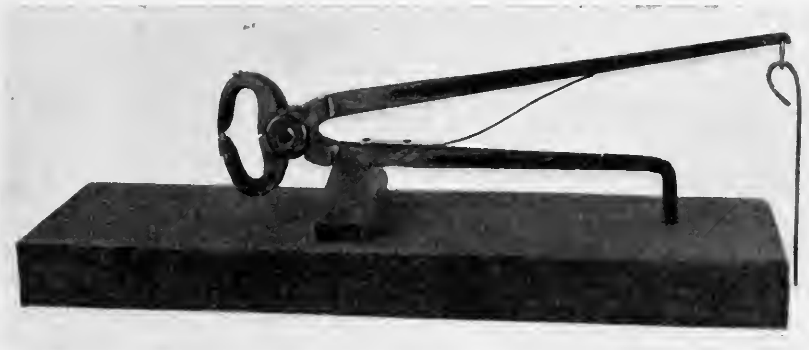


Fig. 3.—Side view of clipper.

five months the highest per cent of germination obtained was 29 per cent of the original seed, 48 per cent of the separated seed, and 55 per cent of that which appeared to be perfect on inspection. Later tests indicate that the seed was planted too deep and kept too wet. The varying percentages of germination, however, are probably a fair measure of the utility of the various methods of preliminary treatment. They indicate that soaking in water for fifteen days, in 10 per cent

Fig. 4.—End view of clipper.

sulfuric acid for one hour, or in 10 per cent caustic potash for sixteen hours, does little or no good. Soaking in strong sulfuric acid for thirty minutes or in lime paste for forty-two hours appears to be injurious. Clipping the shell of the pit, on the other hand, increased the number of seedlings obtained from two to three times.

Fig. 5.—Redding seeds clipped.

Another series of experiments was made with Redding seed of high germinating power. These by examination showed 99 per cent of apparently perfect kernels. After separation in salt solution, the proportion of good seed was practically the same. Three experiments were made as follows:

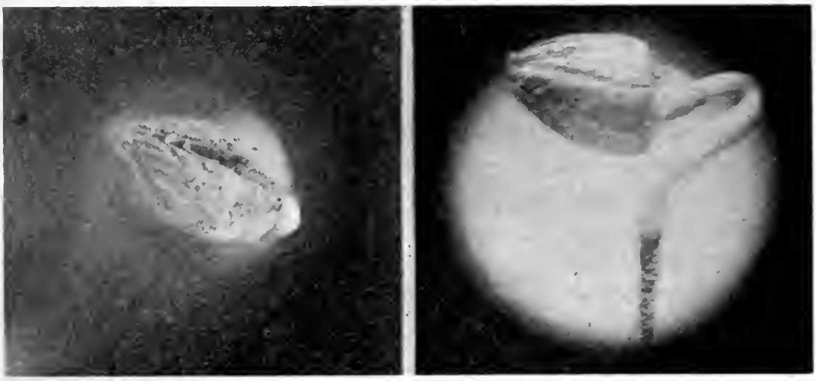
TABLE IV

EFFECT OF CLIPPING SEED

No. of test	Treatment—March	No. used	Number sprouted May 1	June 1	July 1	Aug. 1	Per cent sprouted
1.	Apex clipped	250	....	48	166	221	88.4
2.	Base clipped	250	....	24	84	200	80.0
3.	Untreated	200	....	1	17	60	30.0

The utility of clipping the seed was well demonstrated in this series.

Seed Clipper.—The device finally adopted for clipping the seed was made from a pair of "farriers' nippers," fourteen inches long with a



a *b*

Fig. 6.—Germination of olive seed clipped at the apex.

one-inch jaw. This was mounted on a board, as illustrated in figure 3. A spring between the handles kept the jaws open. The point of the pit was clipped by inserting it between the jaws and then closing them by pressing with the foot on a wire loop attached to the upper handle. In order to prevent the pit being inserted too far, a shield consisting

Fig. 7.—Stages in the germination and growth of an olive seedling.

of a thin piece of brass was rivetted to the immovable upper jaw. In this shield a slot was cut $\frac{9}{32}$ of an inch wide for the insertion of the pit. To prevent cutting the kernel, a rounded notch was filed in each jaw, forming when closed a hole $\frac{2}{16}$ of an inch in diameter vertically and $\frac{3}{16}$ horizontally. This hole is not circular as it appears in figure 4.

This clipper is suited for small seeds, such as those of the Redding, which seems the most suitable for the purpose of any variety available in California.

The work of clipping with this machine is easily and rapidly done. From 1200 to 1500 seeds per hour can be clipped with very little practice. The appearance of the seeds after clipping is shown in figure 5.

By reference to Tables III and IV it will be seen that a somewhat larger percentage of germination was obtained where the apex or pointed end was clipped than where the clipping was done at the base. The superiority in rapidity of germination is even more marked than the total number.

The probable reason of this superiority is shown by figure 6, *a* and *b*. This shows that the radicle or germinating point of the seed lies at the apical end and that when the shell is removed from this end it emerges and penetrates immediately into the soil. When the base is clipped the radicle cannot emerge until the pit splits. Various stages in the germination and growth of the seedling are shown in figure 7.

Treatment with Hot Water.—The germination of many seeds is facilitated by a preliminary immersion in hot water. The effect of this treatment on olive seed is shown in Table V.

TABLE V

EFFECT OF TREATMENT WITH HOT WATER

(100 Redding seeds from Davis in each test; planted Feb. 19, 1915)

No. of test	Treatment	Number sprouting			
		May 1	June 1	July 1	Aug. 16=total %
1.	Soaked 48 hrs. water 40° C.	0	10	20	32
2.	Soaked ¼ hr. water 55° C.	1	23	28	35
3.	Soaked 1 hr. water 55° C.	15	17	24	30
4.	Soaked 1 hr. water 60° C.	0	1	1	1
5.	Soaked ¼ hr. water 60° C.	6	24	27	44
6.	Soaked 48 hrs. water cold	5	18	27	43
7.	Untreated	1	17	24	40

Soaking for one hour in water of 60° C. (140° F.) evidently killed most of the seed (Test 4). The differences between the final results of the other tests and of the untreated seeds are slight and perhaps within

the limits of experimental error. Soaking in cold water for two days or in hot water for a short time apparently hastens germination. This acceleration of germination is most noticeable in No. 3, where the seed was soaked for one hour in water at 55° C. (131° F.). The total germination of 30 per cent compared with the 40 per cent of untreated seed indicates, however, that some of the seed was injured. There is no evidence, therefore, that water treatment is of any value.

Freezing the Seed.—Freezing has been found beneficial in hastening the germination of some hard seeds, such as those of peaches. The effect of freezing was, therefore, tested with olive seeds. Temperatures of from —12° C. to —16° C. for various lengths of time were used. Some of the seeds were immersed in water during freezing and some were simply wet. The pits were placed in small metal-covered cans and immersed in a freezing mixture composed of two parts of broken ice and one part of fine table-salt.

TABLE VI

EFFECT OF FREEZING

(100 Redding seeds from Davis in each test; planted Feb. 19, 1915)

No. of test	Treatment	Number sprouting May 1	June 1	July 1	Aug. 16=total %
1.	In water; —12° C. for 3 hrs.	0	0	1	5
2.	Wet; —12° C. for 3 hrs.	0	0	3	5
3.	In water; —12° C. to —16° C.; 1 hr. for 3 successive days	0	0	0	0
4.	Wet; —12° C. to —16° C.; 1 hr. for 3 successive days	0	0	0	0
5.	In water; —12° C. to —16° C.; 2 hrs. for 3 succesive days	0	0	0	0
6.	Wet; —12° C. to —16° C.; 2 hrs. for 3 successive days	0	0	0	0

No beneficial results were obtained in any case. Three successive freezings killed all the seed. One freezing to —12° C. (10.4° F.) killed most of the seed. The effect of cold on dry seeds was not tested. Cooling to —3° C. for one to forty-eight hours had no perceptible effect, but the tests were not very conclusive.

C. MOST FAVORABLE CONDITIONS FOR GERMINATION

Successful germination depends not only on the condition of the seed when planted, but on the environmental conditions after planting. These conditions are the temperature, the moisture and the aeration, for each of which there is probably an optimum. Tests were made to

determine the most favorable conditions in each of these respects. The seeds used were Redding from Davis, practically 100 per cent viable. The pits were all clipped at the apex.

Temperature.—For this test the pits were planted in six-inch flower pots painted with paraffin to conserve the moisture. They were placed one-half inch deep in a medium light sandy soil. Two somewhat constant temperatures, that of the office regulated by a steam radiator, and that of an incubator regulated by a thermostat, and two variable temperatures, that of a greenhouse and that of the outside air, were tried. The results are shown in Table VII.

TABLE VII

EFFECT OF TEMPERATURE ON GERMINATION

(55 Redding seeds in each test; planted Feb. 22, 1915)

No. of test	Temperature conditions	Number sprouting May 1	June 1	July 1	Aug. 16	Total per cent
1.	Outside, mean 55° F.	0	23	29	29	53
2.	Office, mean 68° F.	0	33	34	35	64
3.	Incubator, mean 77° F.	0	0	0	0	0
4.	Greenhouse, mean 80° F.	0	35	46	47	85

(It is possible that the seeds in the incubator may have become too dry.)

Omitting Test No. 3, it is plain that the higher the temperature, the more rapid the germination. The outside temperature was of course variable and that of the greenhouse still more so. In the latter case the temperature on a sunny day often exceeded 100° F. and on a cold night sometimes fell to 45° F. These variations, however, seem to have had no effect either good or bad. The failure of the seeds at 77° F. in the incubator is unexplained, but it is possible that they were allowed to become too dry at some time after starting.

Moisture.—The results given in Table VIII under this heading were the result of an accident, but are none the less suggestive. Four rows of seed were planted side by side in the hot-house. One row received the ordinary daily sprinkling only. Another was kept excessively wet by drip from an overhanging gutter. A third received a portion of this drip and a fourth a smaller portion. Four increasing amounts of moisture contents are, therefore, represented in the soil of the four rows. There was evidently sufficient moisture in the row receiving the smallest amount.

TABLE VIII

EFFECT OF VARYING DEGREES OF MOISTURE IN SEED BED

(55 Redding seed in each test; planted March 24, 1915)

No. of test	Moisture conditions	Number sprouting May 1	June 1	July 1	Aug. 1	Total per cent
1.	Received drip from gutter	0	17	23	28	51
2.	Received less drip from gutter	0	32	36	36	65
3.	Received still less drip from gutter	0	40	46	46	84
4.	Sprinkled once a day, no drip	0	43	47	53	96

The deleterious effect of excessive watering is plainly shown by these tests. The injury in this case is probably indirect and due to the shutting off of oxygen by preventing proper aeration. It is probably of the same character as that shown in the next tests.

Soil Texture and Depth of Planting.—While both the physical and chemical nature of the soil will undoubtedly affect the growth of the seedling after it has started, it seems probable that the germination of the seed is independent of the chemical nature. The effect of the soil on germination depends principally on the way in which it affects the temperature, moisture and aeration. The tests shown in Table IX were made in the hot-house and the moisture received was sufficient in all cases. The differences in results were therefore due almost or entirely to differences in aeration. The heavier the soil and the deeper the planting, the more the seed was removed from the influence of the oxygen of the air.

TABLE IX

EFFECT OF SOIL TEXTURE AND DEPTH OF PLANTING

(Redding seed)

No. of test	Nature of soil	Depth of planting	No. seed planted	Date of planting	Number sprouting Aug. 1	Per cent
1.	1 part sand 1 part compost	1 in.	100	Feb. 19	44	44
2.	2 parts sand 1 part compost	½ in.	55	Feb. 22	47	85
3.	4 parts sand 1 part compost	⅛ in.	55	Mar. 24	53	96

This experiment indicates clearly that a light, open, well-aerated soil is most favorable to germination. It also indicates that the shallower the seed is planted the better, providing it is not allowed to become too dry.

Grafting Stock.—There is nothing in these experiments to indicate what is the best stock on which to graft our olives. They show, however, that Redding seedlings have many of the characteristics of a good grafting stock, and grafted trees at present bearing in many orchards show that they have others.

Many Redding trees are scattered all over the state and the variety is fruitful. This makes it easy to procure the seed in any desired quantities. The seed is small and of very high germinating power. The growing of seedlings is therefore simple. The seedlings are very uniform in size and character, making it possible to obtain grafted trees of even size and rendering it probable that their bearing qualities

Fig. 8.—Redding seedlings on right; Algerian on left. Both five months from seed.

will also be uniform. Finally, the seedlings are vigorous and readily take the graft with which they make an excellent union.

Incomplete tests have been made with other stocks, but so far none of them has shown any superiority over the Redding.

In Europe and Africa it is a common practice to plant the seed of wild olives, or to use wild olive seedlings found in the woods. A test was made with some seed collected by Professor R. E. Smith from a wild olive growing in Algeria. At first it promised to be superior to Redding in rapidity of growth. The seeds were very small and germinated very readily and the seedlings grew vigorously and quickly. Figure 8 shows the relative size of the two kinds at five months.

This inferiority of size of the Redding, however, was almost overcome at twenty months after growing six months in the nursery. The

Fig. 9.—Redding seedling to right; Algerian on left. Both twenty months from seed.

low, spreading, bushy form of the Algerian seedling also was less suitable for nursery work than the tall upright growth of the Redding (see fig. 9).

CONCLUSIONS

These results make it possible to recommend a simple and rapid method of raising Redding seedlings for grafting stock.

1. The fruit should be gathered when perfectly ripe and the pulp removed from the pits. This is most easily done by immersing the olives in a 3 or 4 per cent soda lye for several hours to soften the skin. After washing off the lye, the pulp can be removed by rubbing through a wire sieve of $3/16$-inch mesh.

2. The cleaned seed is then placed in 25 per cent brine (two pounds common salt to one gallon water), and all floating seed rejected.[2]

3. The apex or pointed end of each seed is then clipped, as described.

4. The clipped seed is planted directly in flats containing a light porous soil (sand three parts, leaf mold one part). The seed should be planted one-eighth to one-quarter inch deep and the surface of the soil covered with one-eighth of an inch of sifted moss or similar material.

5. The planted flats should then be placed in a greenhouse, cold-frame or ordinary seed-bed, and watered only enough to prevent complete drying of the layer around the seed. The warmer they are kept, the more rapidly the seed will germinate and grow.

6. The seedlings will commence to come up in four or five weeks and continue for two, three, or more months. At the end of about five months from planting they may all be transplanted to small pots, but they will be of many sizes, varying from a few inches to two or more feet (see figs. 10 and 11). It is probably best to pot them as soon as they reach four or five inches, as in figure 10. This will necessitate going over the seed-beds several times, but they will probably make larger trees for grafting in the spring than if they are set back by transplanting when large as in figure 11.

7. The potted seedlings are kept in a greenhouse, lathhouse or other protected place until the following spring. When the weather and the soil warm up, about April, they can be planted in the nursery and the following autumn and the next spring they will be ready for budding or grafting.

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2 Wash seed to remove salt before planting.

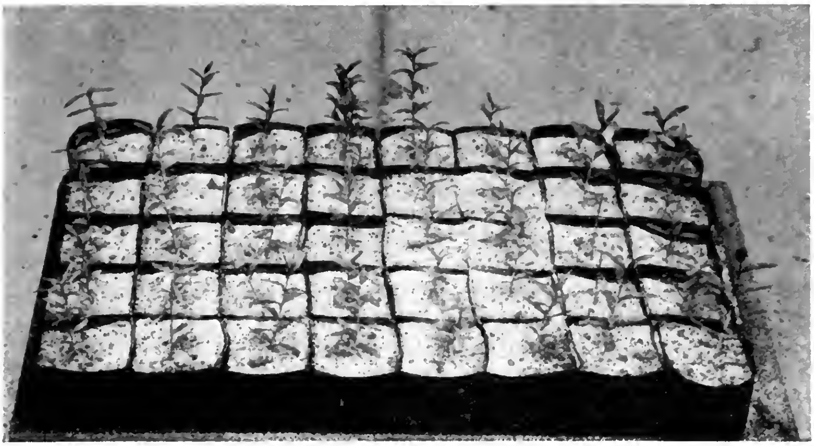

Fig. 10.—Seedlings potted when 4 to 5 inches high.

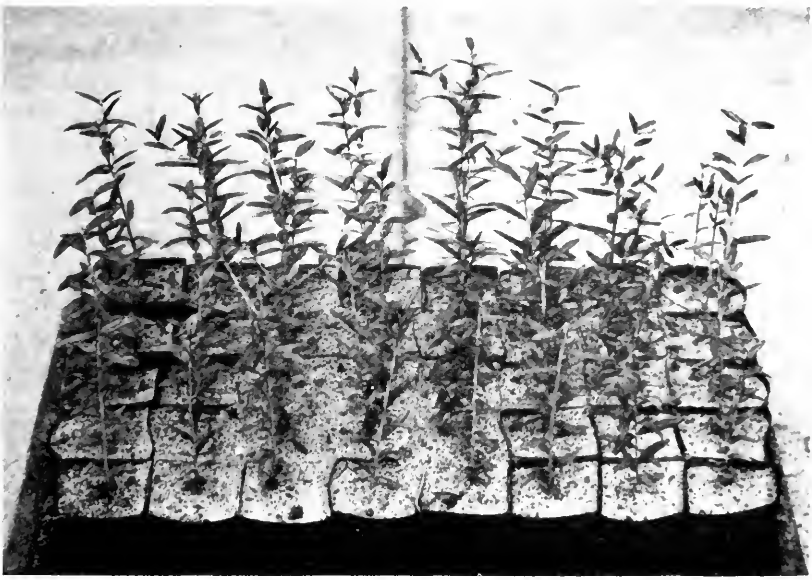

Fig. 11.—Seedlings potted when 1 to 2 feet high and cut back to 6 to 8 inches.

PART II.—GRAFTING OLIVE SEEDLINGS

By FREDERIC T. BIOLETTI AND F. C. H. FLOSSFEDER

Olive seedlings are usually budded or grafted in the nursery. This seems to be the best way, though it is possible to plant the seedlings in place in the orchard and graft them one or more years later.

Buds may be put in during the autumn to unite and remain dormant until the following spring, or they may be put in during the spring as soon as the sap is flowing freely. Spring buds grow the same year, but do not make so large a growth during the season as those put in the previous autumn.

Grafting can be done in almost any month, but the best time seems to be just at the start of new growth, a little before the time for spring budding, usually about the middle of March in most localities.

Some growers bud their nursery plants in the autumn and graft during the following spring all on which the buds do not "take." This seems to be a good method, as it diminishes the number of failures. The bud is inserted four to six inches above the surface of the ground and the grafting is done at or just above the surface.

Neither budding nor grafting are very difficult if good scions are used. The graft scions or bud sticks should be as fresh as possible. If kept for even a few weeks they do not grow nearly so readily. They should have well formed buds. Twig buds can be used, but more of them fail; the ordinary shield bud in a T slit is the simplest form and seems as good as any. For grafting, a method by which the stock is not split seems to be the best. The bark or crown graft is the form usually employed. The scions should be not only fresh, but well developed and at least three-sixteenths of an inch in diameter; about one-quarter of an inch is perhaps the best size. If over three-eighths of an inch they are difficult to fit properly.

GRAFTING EXPERIMENTS

In order to determine the best method of tying, waxing and covering nursery grafts a series of tests was made at Davis in 1915.

Nursery Grafting.—The stock used in these tests were well-grown Redding seedlings similar to that shown in figure 12. They were just

two years old from the planting of the seed and varied in diameter at the base from three-eights to five-eights inches.

Fig. 12.—Redding seedlings, two years old.

Seed planted,	March, 1913
Plant potted,	August 1913
Put in nursery,	May, 1914
Grafted,	March, 1915

The scions were taken from old Mission trees growing on the University Farm. The kind of scion and method of cutting are shown in figure 13. They were of good quality with well-formed dormant buds

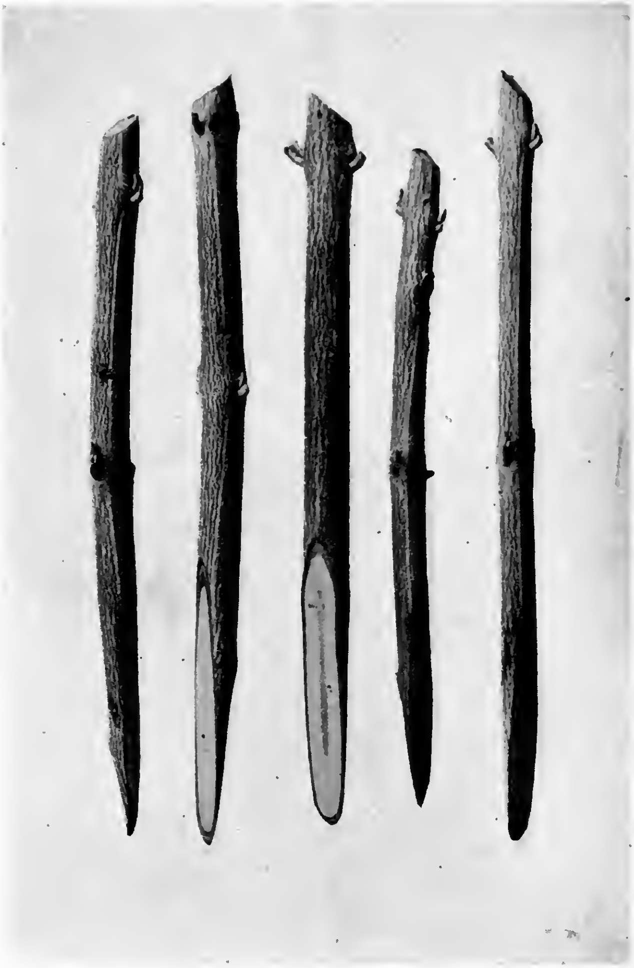

Fig. 13.—Mission scions—slightly reduced.

and somewhat smaller than the stock, from one-eighth to four-eighths inches in diameter.

The method of grafting was that usually called bark or crown grafting and consists of inserting a scion, cut to a long single bevel, underneath the split bark of the stock, which has previously been cut

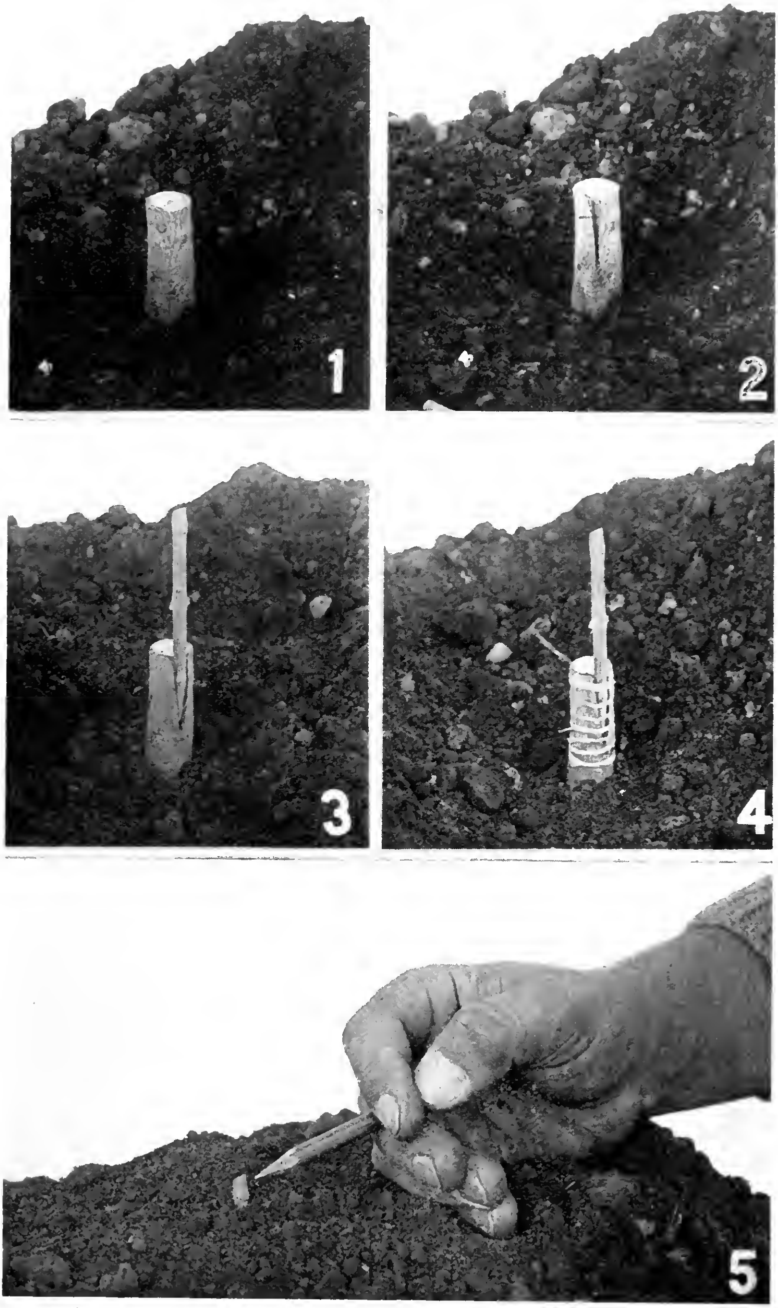

Fig. 14.—Method of grafting olive seedlings in nursery.
1. Stock decapitated. 2. Bark split. 3. Scion inserted.
4. Graft tied. 5. Graft covered with moist soil.

off an inch or so above the surface of the ground. The method is shown in figure 14. The 209 grafts made were treated in three different ways as follows:

Exp. 1. Tied with raffia, waxed, and covered with soil to just above the union.
Exp. 2. Tied with raffia, waxed and covered with soil to the top of the scion.
Exp. 3. Tied with cotton string, no wax, covered with soil to the top of the scion.

The grafting was done on March 19, and on July 1 the results were noted as follows:

Exp. 1. 20 strong grafts, 6 weakly. Good grafts, 24.7%
Exp. 2. 44 strong grafts, 6 weakly. Good grafts, 54.3%
Exp. 3. 36 strong grafts, 5 weakly. Good grafts, 76.6%

From this it appears that for the conditions of the test the following conclusions may be drawn:

1. Deep covering of the graft with moist soil is necessary. Compare Experiments 1 and 2.

2. When the grafts are covered deeply, waxing is detrimental. Compare Experiments 2 and 3.

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